We claim:

1. A transition for delivering an electrical signal propagating on a coaxial cable to a substrate, comprising:

an input connector adapter configured to receive and retain a coaxial cable having a central conductor;

a housing that defines a cavity having an axis;

an airline conductor situated substantially parallel to the axis of the cavity and in electrical communication with the central conductor of the coaxial cable, wherein the airline conductor and the cavity are configured to form an airline having an impedance that is substantially the same as an impedance of the coaxial cable; and

an interconnect situated on the substrate and extending into the cavity and electrically connected to the airline conductor.

2. The transition of claim 1, wherein the cavity is cylindrical.

3. The transition of claim 2, wherein the interconnect includes a conductive puck.

4. The transition of claim 1, further comprising an output coaxial adapter configured to receive and retain a coaxial cable.

5. The transition of claim 1, wherein the interconnect includes a conductive puck.

6. The transition of claim 5, wherein the substrate is retained by the housing.

7. An apparatus for delivering an electrical signal from a coaxial cable to a substrate, comprising:

an airline that includes a central conductor;

means for securing the coaxial cable to the central conductor and communicating the electrical signal to the central conductor; and

means for electrically connecting the substrate to the central conductor, situated within the airline.

8. A method delivering an electrical signal to a substrate, comprising:

configuring an airline to receive the electrical signal, wherein the airline includes a conductor and a cavity, and has a characteristic impedance corresponding to a characteristic impedance of the transmission line on which the electrical signal propagates; and

contacting an interconnect region on the substrate to the airline conductor.

9. The method of claim 8, wherein the characteristic impedance of the airline is approximately equal to the characteristic impedance of the transmission line.

10. The method of claim 8, wherein the characteristic impedance is about 50 Ohms and the transmission line is a coaxial cable.

11. A method of forming a conductive interconnect on a substrate, comprising;

(a) wire bonding a bond wire to a conductive area of the substrate; and

(b) removing the bond wire from the conductive area so that an associated bond ball remains.

12. The method of claim 11, further comprising repeating steps (a) and (b) a plurality of times.

13. A conductive puck, comprising a plurality of conductive bond balls.

14. A sampling circuit, comprising;

a substrate;

a first sampling diode and a second sampling diode defined on the substrate and in electrical communication with a signal input;

a strobe waveguide, defined on the substrate, that includes a first conductor and a second conductor, configured to deliver corresponding strobe pulses of opposite polarity to the first sampling diode and the second sampling diode; and

an intermediate frequency waveguide, defined on the substrate, and that includes a first conductor and a second conductor that are in electrical communication with the first sampling diode and the second sampling diode, respectively, and configured so that signal samples delivered to the first and second conductors by the first sampling diode and the second sampling diode are of the same polarity and strobe portions delivered to the first conductor and second conductor are of opposing polarity.

15. The sampling circuit of claim 14, further comprising varactors configured with the strobe waveguide to form a nonlinear transmission line (NLTL).

16. The sampling circuit of claim 15, further comprising respective diodes that electrically connect the first conductor of the IF waveguide and the second conductor of the IF waveguide to a first conductor of the strobe waveguide and a second conductor of the strobe waveguide, respectively.

17. The sampling circuit of claim 14, wherein the conductors of the strobe waveguide and the conductors of the IF waveguide extend along a common axis.

18. The sampling circuit of claim 17, wherein the conductors of the strobe waveguide are situated symmetrically about the common axis.

19. The sampling circuit of claim 18,wherein the conductors of the intermediate frequency waveguide are situated symmetrically about the common axis.

20. The sampling circuit of claim 19, wherein the conductors of the strobe waveguide are closer to the common axis than the conductors of the intermediate frequency waveguide.

21. The sampling circuit of claim 14, wherein the strobe waveguide and the IF waveguide are coplanar waveguides that are situated along a common axis.

22. The sampling circuit of claim 21, wherein the IF waveguide and the strobe waveguide are situated symmetrically about a common axis.

23. The sampling circuit of claim 22, wherein the substrate is GaAs.

24. A sampling circuit, comprising:

an input configured to receive an electrical signal;

a strobe waveguide situated along an axis;

an intermediate frequency waveguide situated along the axis; and

two sampling diodes that are in electrical communication with the strobe waveguide and the intermediate frequency waveguide and configured to direct samples of the electrical signal to the intermediate frequency waveguide in response to a strobe signal propagating on the strobe waveguide, wherein the strobe waveguide is configured to provide a strobe signal that propagates as an odd waveguide mode on the strobe waveguide and the sampling diodes are configured to direct samples of the electrical

signal to the intermediate frequency waveguide for propagation as an even mode of the intermediate frequency waveguide.

25. The sampling circuit of claim 24 wherein the strobe waveguide and the intermediate frequency waveguide are coplanar waveguides.

26. The sampling circuit of claim 24, further comprising a substrate which the strobe waveguide, the intermediate frequency waveguide, and the sampling diodes are defined.

27. The sampling circuit of claim 24, further comprising a plurality of varactors that, in combination with the strobe waveguide, form a nonlinear transmission line.

28. A sampling circuit that delivers signal samples to a sample output, the sampling circuit comprising a strobe waveguide and an intermediate frequency waveguide configured so that a local oscillator signal propagates on the strobe waveguide in a waveguide mode different from a waveguide mode in which the signal samples propagate on the intermediate frequency waveguide.

29. The sampling circuit of claim 28, wherein the strobe waveguide and the intermediate frequency waveguide are approximately symmetrical with respect to an axis.

30. The sampling circuit of claim 29, wherein the local oscillator signal propagates as an odd mode on the strobe waveguide and the signal samples propagate as an even mode on the intermediate frequency waveguide.

31. A sampling method for sampling an input signal, comprising:

propagating a strobe signal on a strobe waveguide in a strobe waveguide mode;

directing samples of the input signal to an intermediate frequency waveguide with the strobe signal; and

propagating the samples on the intermediate frequency waveguides in a sample waveguide mode, wherein the strobe waveguide mode and the sample waveguide mode are different.

32. The sampling method of claim 31, wherein the strobe waveguide mode is an odd mode and the sample waveguide mode is an even mode.

33. A sampling system, comprising:

a sampling circuit defined on a GaAs substrate, the sampling circuit including (a) a coplanar strip strobe waveguide and a coplanar strip intermediate frequency waveguide that are situated symmetrically about a common axis, wherein the strobe waveguide is situated between the intermediate frequency waveguide and the common axis; (b) a plurality of varactors configured with the strobe waveguide to form a nonlinear transmission line (NLTL); (c) capacitive couplers that connect corresponding conductors of the strobe waveguide and the intermediate frequency waveguide; (d) a signal input that includes a conductive puck; (e) two sampling diodes situated to connect respective conductors of the intermediate frequency waveguide the signal input;

an airline that includes a central conductor in electrical communication with the conductive puck and an input and output connector adapters for connection to corresponding coaxial cables, the airline configured to have an impedance corresponding to an impedance of the coaxial cables;

a local oscillator source that provides an electrical signal to the nonlinear transmission line and, that in combination with the NLTL, produces sampling pulses of opposite polarity;

a signal processor in communication with the intermediate frequency waveguide that receives a signal sample obtained from a signal applied to the airline, wherein the signal sample received from a first conductor of the intermediate frequency waveguide is combined with a strobe sample of a first polarity and the signal sample received from a second conductor of the intermediate frequency waveguide is combined with a strobe sample of a second polarity, opposite the first polarity.